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NASA TECH BRIEF

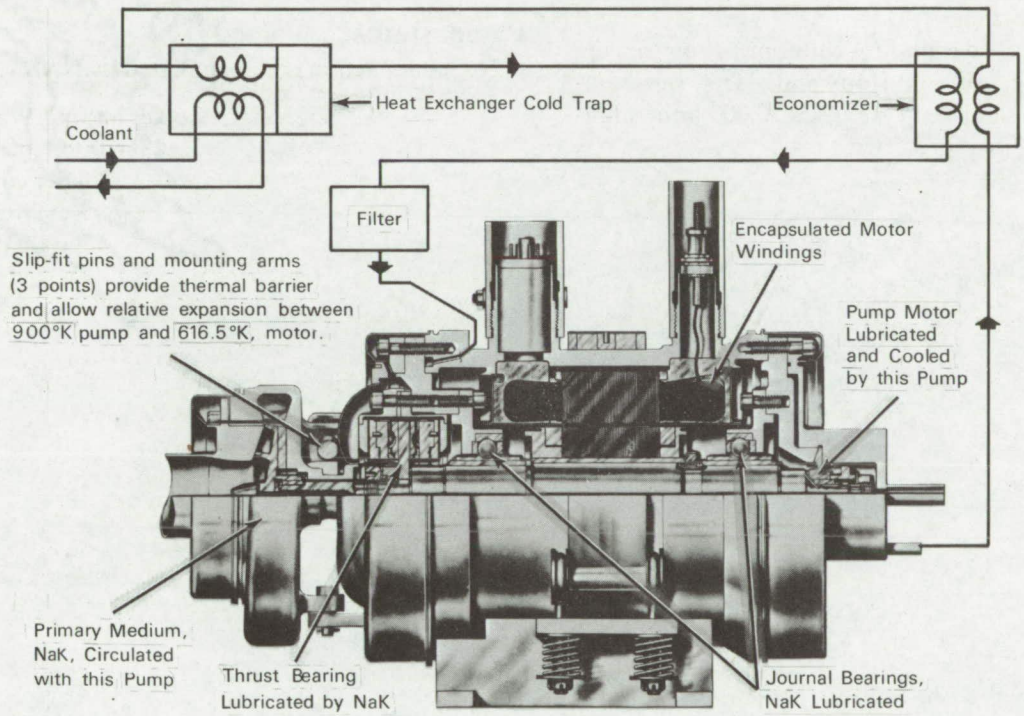
Lewis Research Center

High-Temperature Pump-Motor Assembly

A high-temperature pump-motor assembly has been developed for pumping liquid sodium-potassium (NaK) eutectic at a temperature of 950°K (1250°F) for up to 20,000 hours without maintenance or adjustment. Developed for a 35 kW nuclear, turboelectric space power system, the design incorporates several innovations to achieve the required performance, reliability, and operating life.

Particular design features include: (1) High operating-temperature capability; (2) zero leakage (under vacuum or pressure); (3) process fluid lubricant/coolant; (4) insulation system compatible with ionizing radiation environments; (5) reliability and long life without maintenance; and (6) ability to seal high static pressures.

These features qualify the assembly for pumping high-temperature, dangerous, corrosive and/or valuable liquids; liquids sensitive to contact with the atmosphere; or liquids at extremely high or low absolute pressures. In addition, the assembly could be used for pumping hard-to-seal liquids; liquids which might be contaminated by conventional lubricants; or liquids containing a higher degree of contaminants or solids than can normally be toler-



(continued overleaf)

ated in bearings or seals. The maintenance-free capability makes the system particularly suitable for use in remote or restricted locations.

On one shaft, the pump-motor assembly (PMA) has a centrifugal pump, a sealed drive motor, an internal process fluid lubricant/coolant circulating pump, and process fluid lubricated hydrodynamic bearings. A thermal barrier between the pump and motor allows the motor and bearings to run at a cooler temperature (approx. 620°K = 650°F) than the pump (approx. 900°K = 1160°F). A recirculation system filters and cools the process fluid that is circulated through the motor and bearings for lubrication and cooling. No static or dynamic shaft seals are used. The general design is similar to that of conventional zero-leakage pumps. However, this PMA includes innovations such as the new-design thrust and journal bearings, a high-temperature motor, and a method for connecting the pump and motor housings which minimizes heat transfer, yet allows thermal expansion without high stress, binding, or distortion.

A 10,000-hour design-life endurance run of the PMA, including over 800 stops and starts, was completed with no significant wear. A 20,000-hour minimum operating life is predicted.

Notes:

1. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   References:

   NASA-CR-72823, Design and Development of Canned Motor Pump for High Temperature NaK Service in SNAP-8.

   NASA-CR-72824, NaK Lubricated Journal and Thrust Bearings for a Pump-Motor Assembly in SNAP-8.

2. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B71-10100

Patent status:

No patent action is contemplated by NASA.

Source: C. Colker and W. Waldron of
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